CLAIMS

1. In a bone implant for a bony substance having an implant body with a surface that is compatible with bone cells having an average size and wherein the surface has a macrostructure that contacts the bony substance and a microstructure for anchoring the implant in the cell area, the improvement wherein the microstructure comprises an array of densely packed rounded domes separated by rounded lacunae, and wherein the size of the domes, their distances from one another and the depth of the lacunae are substantially the same order of magnitude as the average size of the bone cells.

2. The improvement of claim 1, wherein parts of the implant body surface are pretreated by sandblasting and acid etching and wherein the microstructure comprises a cover layer formed on the implant body surface parts.

3. The improvement of claim 2 wherein the cover layer is fabricated from a material in the group consisting of titanium and titanium alloys.

4. The improvement of claim 2 wherein the bone cells have a profile with a surface roughness and wherein the cover layer comprises a layer of sputtered material having a thickness which corresponds substantially to the surface roughness of the bone cell profile.

5. The improvement of one of claims 2-4 wherein the cover layer has a thickness between 0.1 and 2 micrometers.

6. The improvement of one of claims 2-4, wherein implant body surface parts which are pretreated by sandblasting and acid etching and on which is

formed the cover layer are delineated from other surface parts of the implant by masking.

7. The improvement of claim 1 further comprising a nanostructure superimposed on the microstructure, the nanostructure being comprised of a densely packed array of rounded domes separated by rounded lacunae, wherein the size of the nanostructure domes, the distances from one nanostructure dome to another and the depth of the nanostructure lacunae are smaller than the corresponding dimensions of the microstructure by approximately one decimal order of magnitude.

8. The improvement of claim 7, wherein the depth of the nanostructure lacunae is in the range of 10-500 nm wherein and the distance between nanostructure domes is in the range of 100-500 nm.

9. A method of producing a bone implant that is compatible with bone cells having an average size, the method comprising:

(a) fabricating an implant body with a biocompatible surface,

(b) pretreating parts of the implant body surface to roughen the implant body surface;

(c) reshaping the roughened implant body surface by application and removal of material to create a microstructure comprised of an array of densely packed rounded domes separated by rounded lacunae; and

(d) selecting parameters of steps (b) and (c) so that a size of the domes, distances from one dome to another and a depth of the lacunae are substantially the same order of magnitude as the average size of the bone cells.

10. The method of claim 9 wherein step (b) comprises sandblasting the implant body surface.

11. The method of claim 9 wherein step (b) comprises acid etching the implant body surface.

12. The method of claim 9 wherein step (b) comprises sandblasting the implant body surface and acid etching the sandblasted implant body surface.

13. The method of any one of claims 8-12, wherein step (c) comprises applying a cover layer to the roughened implant body surface.

14. The method of claim 13, wherein step (c) comprises applying the cover layer by sputtering.

15. The method of claim 13, wherein step (c) comprises applying the cover layer by electroplating.

16. The method of any one of claims 9-12, wherein step (c) comprises treating the roughened implant body surface with a laser so that roughness peaks produced by step (b) are worn down and notch-like indentations are reshaped to form rounded lacunae.

17. The method of any one of claims 9-12, wherein step (c) comprises treating the roughened implant body surface by a galvanic erosion process so that roughness peaks produced by step (b) are worn down and sharp-edged indentations are filled up to form rounded lacunae.

18. The method according to claim 17, wherein the roughened implant body surface functions as a cathode in the galvanic erosion process for removal of the roughness peaks.

19. The method of claim 15, wherein the cover layer is applied up to a thickness that corresponds substantially to a surface roughness of a bone cell profile.

20. The method of claim 19, wherein the cover layer is applied to a thickness between 0.1 and 2 micrometers.

21. The method of claim 9, wherein the implant body surface parts to be treated in step (b) and step (c) are delineated from other surface parts of the implant body by masking, and the other surface parts are covered while the method steps (b) and (c) are being carried out.

22. The method of claim 9, wherein step (a) comprises fabricating an implant body with a macrostructure to fasten the implant body into bone and wherein the microstructure formed by steps (b) and (c) is applied to the macrostructure.

23. The method of claim 9, further comprising:

(e) forming a nanostructure on the microstructure, the nanostructure being formed by an array of rounded domes separated by rounded lacunae wherein a size of the nanostructure domes, a spacing between the nanostructure domes and a depth of the nanostructure lacunae are substantially one decimal order of magnitude smaller than corresponding dimensions of the microstructure.

24. The method of claim 23, wherein the depth of the nanostructure lacunae is in the range of 10-500 nm and the spacing between the nanostructure domes is in the range of 100-500 nm.